IV & Infusion Therapy Certificate

November 2020

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Tania Xerri, Director, Health Leadership and Learning Network
A Leader in Health Continuing Professional Education
Faculty of Health York University
4700 Keele St. HNES 019, Toronto, ON M3J 1P3

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IV & Infusion Therapy Week 1

Karen Laforet MClSc, RN, CHNC (C), VA-BC™, CVAA (c)

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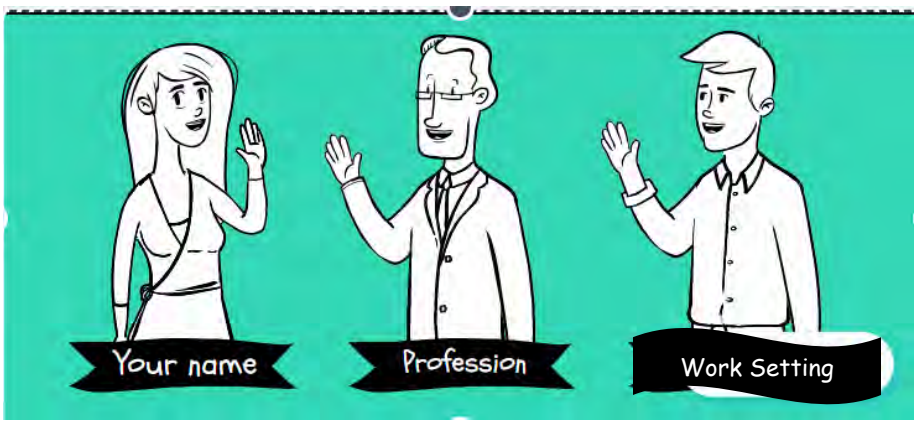
Introductions



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Objectives:

- By the conclusion of this session, participants will be able to:
- Review rationale for infusion therapy
- Define common universal terms used for infusion therapy and vascular access
- Discuss core safe infusion practices
- List six function of the integumentary system
- Identify risk to skin integrity for a person receiving IV therapy
- Compare the sympathetic and the parasympathetic nervous systems.

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Vascular Access gone wrong…

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Core Practice Principles

- Foundational elements to all practice:
- Infection Prevention and Control
- Ethics
- Evidence-Informed Practice
- Informed Consent
- Hand Hygiene
- Safe Handling and Disposal of Hazardous Materials & Sharps
- Product use (following Manufacturer's instructions)
- Patient Education and Competency
- Documentation.

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Infusion Therapy: History

- 1656 Sir Christopher Wren—used quill and bladder to inject dog with opium
- 1667: 1st human transfusion: 15 yr boy France (Jean Baptiste Denis, King's physician)
- 1834: Dr. James Blundell transfused women hemorrhaging post-partum
- 1900 Karel Landsteiner : 3 out of 4 blood groups
- 19
- 1
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- 19
- **1975: Canadian Intravenous Nurses Association (CINA) founded**
- 1980: First Standards of Practice published by National Intravenous Therapy Association (NITA—now known as INS)
- 1983: Home infusions started and in US, first blood transfusion initiated
- 2006: CINA changed name to Canadian Vascular Access Association (CVAA)

1964 First **disposable cannula** introduced—one of the greatest modern inventions

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Infusion Therapy

- It is the most common invasive procedure in health care.
- 90% of all patients who experience healthcare will have an IV at some point in time (ISMP 2015, CDC 2012, SHN)

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What…is infusion therapy


Google image

- **Introduction** of fluids, blood, and drugs directly into the vascular system: i.e. arteries, bone marrow and veins.

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Why Infusion Therapy?

- To administer fluids and medications
- To provide parenteral nutrition
- To provide avenue for dialysis/apheresis
- To transfuse blood products
- To provide avenue for hemodynamic monitoring
- To provide avenue for diagnostic testing

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Goal of Infusion Therapy

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- **Positive outcome**
- **First stick Success**
- Painless (#6 worry for patients is painful IV start)
- Effective treatment
- Complete recovery (the why)

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Healthcare professionals need to be proficient in the assessment, selection, insertion and care & maintenance of vascular access devices and the infusions/medications provided

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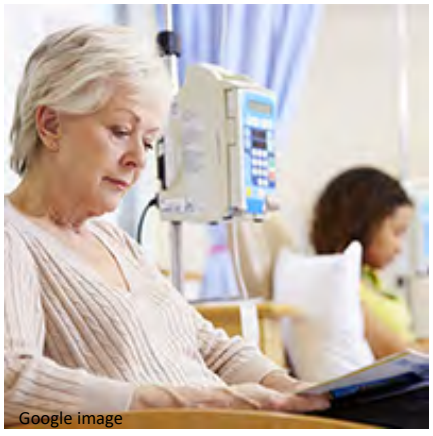
CRITICAL for patient safety

Early recognition and prevention of complications.

Knowing anatomy, physiology and pathophysiology will minimize patient risk



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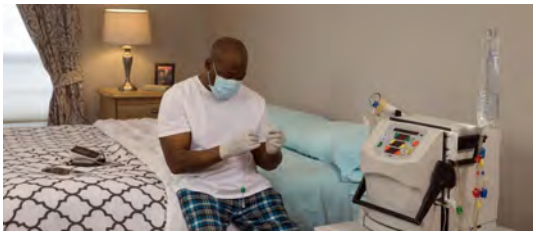



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Common Terms

- Infusion therapy: replaces IV therapy—it's more than 'pick and stick'
- VAD: Vascular access device (VAD) in place of IV catheter
  - PVAD in place of PIV
  - CVAD in place of central line or CVC or CIC
- Health Professional (HP or HCP) in place of nurse, doctor, phlebotomist…etc.
- DIVA: Difficult IV access

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Infusion related clinical competencies

Core content areas:

- Anatomy & Physiology
- Fluids & Electrolytes
- Vascular Access—peripheral & central: assessment, selection, care & maintenance
- Infection control and safe infusion practice
- Complications
- Pharmacology (including chemotherapy)
- Pediatric Population Implications
- Geriatric Population Implications
- Transfusion Medicine
- Parenteral Nutrition

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Documentation

- Use standardized medical terminology and approved abbreviations.
- Ensure all documentation includes date, HCP signature, and credentials.
- Use standardized templates to document VAD insertion, care and maintenance, and infusion therapy (e.g., flow sheets)
- Document procedural compliance and task completion for CVADs (e.g., insertion checklists)
- Consider use of structured checklists for peripheral vascular access device (PVAD) insertion.
- Include the following in all procedural documentation
  a) Procedural details, including any deviations
  b) Barriers to care when present
  c) Patient participation in, understanding of, and responses to therapy and intervention
  d) Evaluation of expected outcomes, side effects and adverse events, including intervention and patientresponse
  e) Relevant lab results.

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Identify 10 things wrong in this video

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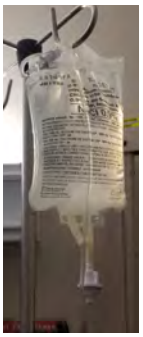
Common Sources of PVAD Contamination


Hand Hygiene


VAD Location


Skin Surface


Contaminated Equipment


Idle Catheters


Asepsis breach

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Hand Hygiene [7,8]

Sax H, et al. J Hosp Infect 2007; 67(1): 9–21

Hand hygiene is the simplest, most effective measure for helping to prevent healthcare association infections.

Compliance ranges 40-60% among healthcare workers.

Research shows that there are even lower rates of hand hygiene when gloves are worn.

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E. Hand Hygiene

What is the preferred method of hand hygiene?

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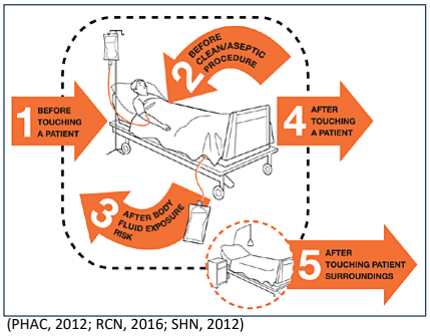
Moments of Hand Hygiene

1. Perform hand hygiene at the standard moments of hand hygiene, including, but not limited to (PHAC, 2012; RCN, 2016; SHN, 2012): [IA]



(PHAC, 2012; RCN, 2016; SHN, 2012)

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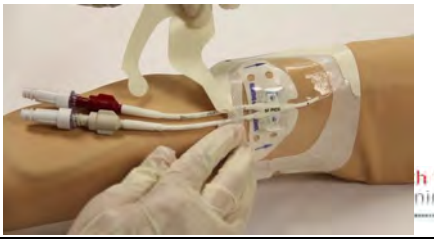
Hand Hygiene: VA & Infusion Therapy (CVAA 2019)

1. Before and after palpating insertion

2. Before handling or manipulating infusion system

3. Before putting on and after removing gloves

4. Before and after inserting, or replacing, or accessing, or repairing or dressing a VAD



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Provide information to patients on WHEN and HOW to perform hand hygiene.

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- Clinical implications for infusion therapy:
- Physical & functional characteristics
  - Integumentatry
  - Nervous
  - Circulatory
  - Vascular
  - Skeletal
- **Know** location of veins, arteries, nerves for vascular access

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The skin of terrestrial animals is **essential** for their survival….the **principle role** of skin is to keep harmful agents out and water in. In order to accomplish this seemingly trivial task, nature has developed an elaborate structure, termed the **stratum corneum**, which provides to the skin its barrier function.

Schaefer and Redelmeier

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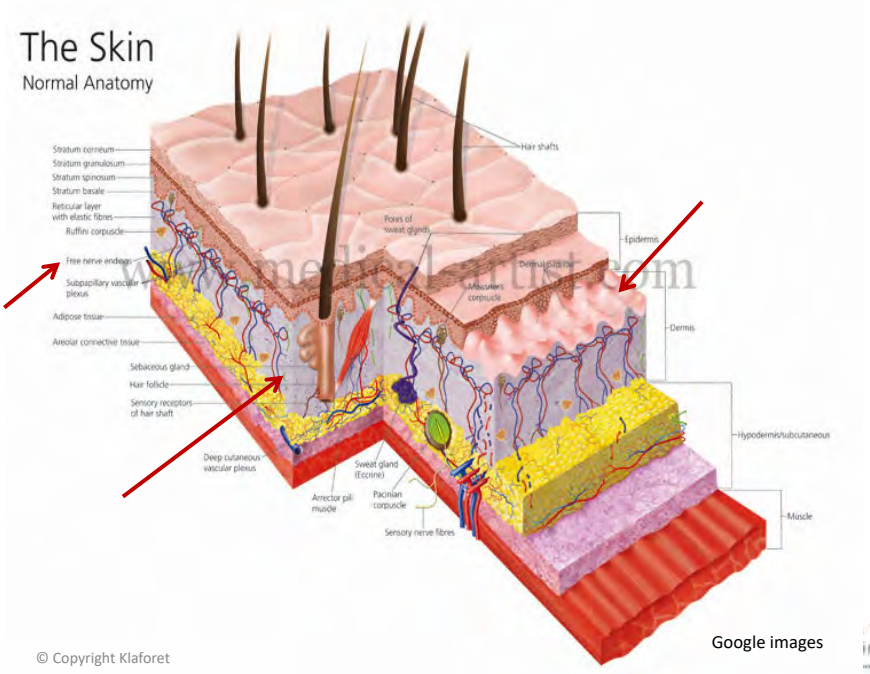

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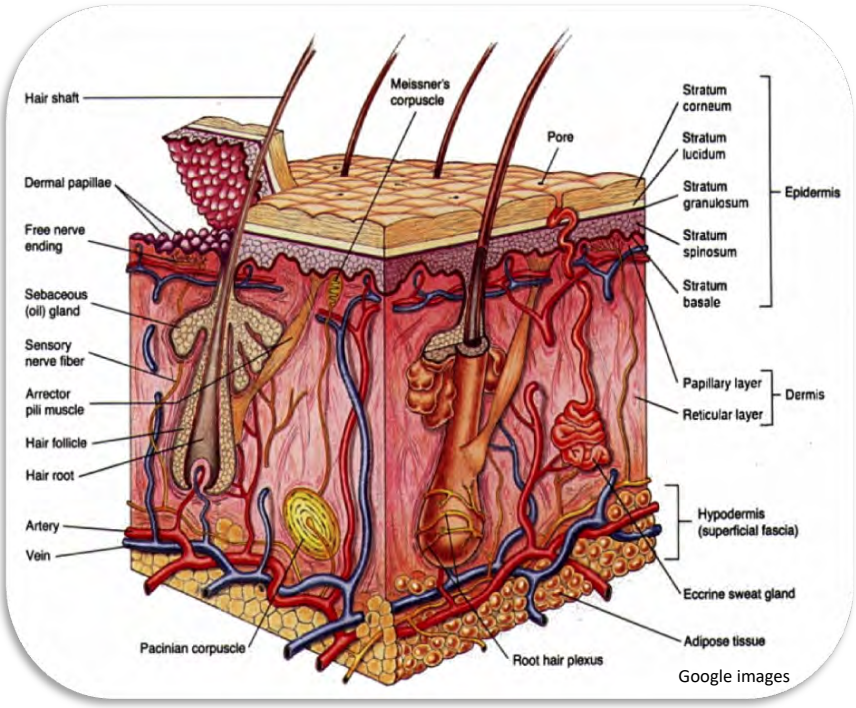

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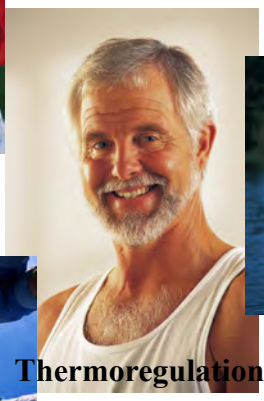
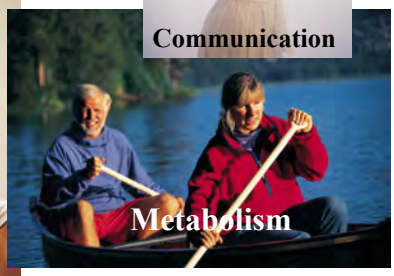
Skin Function





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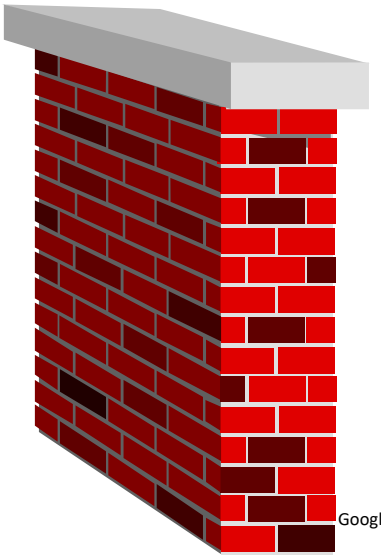
Protection

- Stratum corneum (uppermost layer)
  - Thickness= .01 mm
  - Composed of
    - Corneocytes
    - Water
    - Lipids
  - Semi-permeable



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Protection

- **Fibroelasticity**
  - Stress against mechanical forces
- **Transepidermal Water loss (TEWL)**
  - Evaluates barrier function

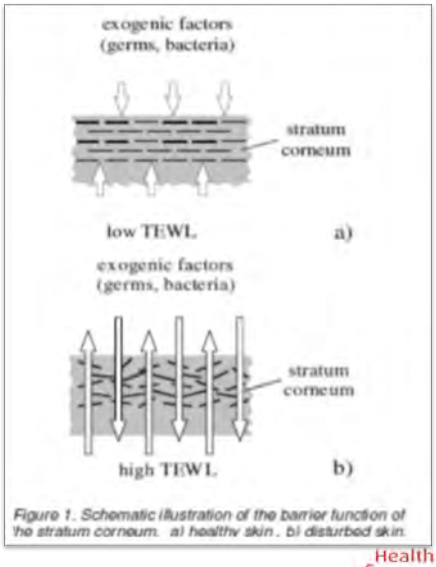

Figure 1. Schematic illustration of the barrier function of the stratum corneum. a) healthy skin. b) disturbed skin.

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Thermoregulation

- Maintenance of body temperature:
  - Vasoregulation
  - Sweating
  - Eccrine Glands
  - Apocrine Glands

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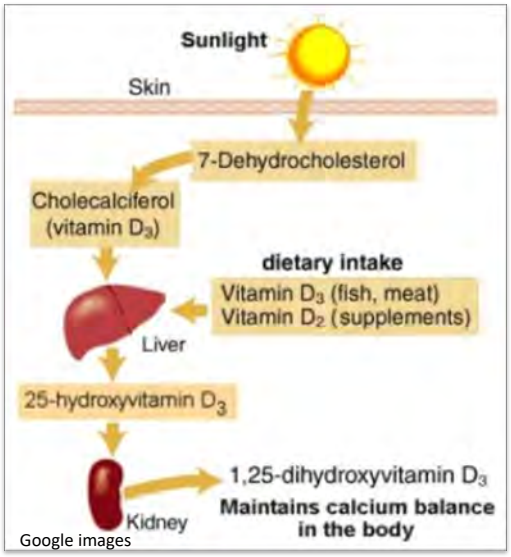
Synthesis of Vitamin D



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Immunity

- Microflora
- Langerhans's cells
- Dermal lymphatics
- Mast Cells

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Resident vs Transient Microbiota

- **Resident**
- Acquired rapidly during & after birth
- Always present
- Unable to remove
- In health human internal tissues are free from microorganisms
  - Blood
  - Brain
  - Muscle
  - CSF

- **Transient**
- Live in or on the body for a period of time (hours, days, weeks, or months) then move on or die off
- Cannot live on d/t competition, elimination by body's defenses or chemical/physical changes in the body
- Able to remove through washing

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Symbiotic Relationship

- **Mutualistic**
  - Both organisms benefit (e.g. E. *Coli* synthesizes Vit K & B)
- **Commensalistic**
  - None with Bacteria
  - If on/in the skin either helping or harming
- **Opportunistic**
  - Pathogenic outside normal environment (e.g. E. *Coli*, Staph *aureus*

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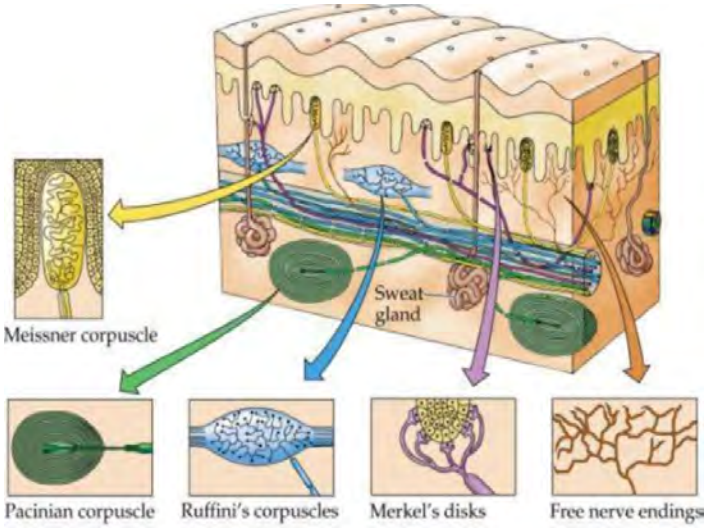
Communication & Sensation



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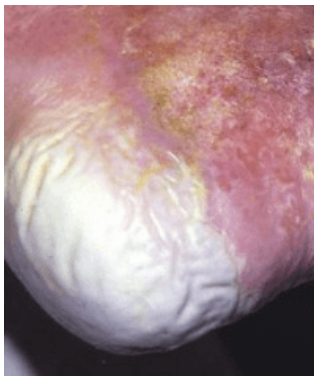
Threats to Skin Integrity

Moisture Associated Skin Damage (MASD)

General term for inflammation or skin erosion caused by prolonged exposure to a source of moisture such as urine, stool, sweat, wound drainage, saliva, or mucus



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Medical Adhesive-related skin injury (MARSI):

- Prevalent, under-recognised and preventable complication specifically related to skin damage caused by medical adhesive
- Can occur in any patient group or setting

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Chemicals

- Antiseptics
- Skin barriers
- Soap
- Tackifiers

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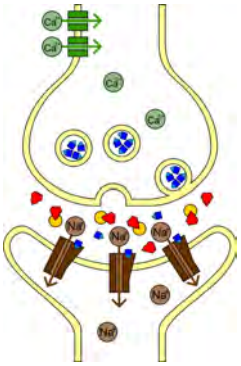
Nervous System

- Information travels from one neuron to the next via synapses:
  - Electrical—thru open fluid channels between nerve cells
  - Chemical
    - Small molecule rapid acting (acetylcholine, epinephrine, norepinephrine, histamine)
    - Neuropeptides –slow-acting (vasopressin, insulin, angiotensin II, oxytocin, bradykinin)



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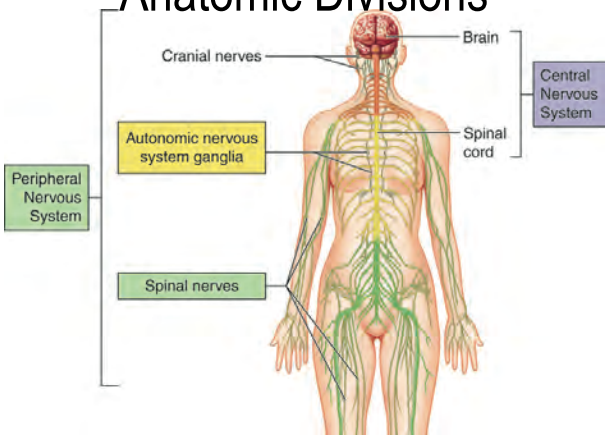
Anatomic Divisions



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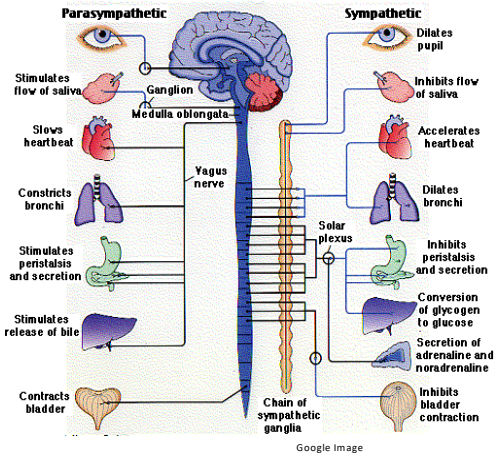
Autonomic Nervous System



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Sensory Receptors r/t IV therapy

Receptor	Sensation	Effect on IV therapy
Mechanoreceptor	Skin tactile senses Deep tissue. Arterial pressure controlled thru baroreceptors (large arteries)	Palpating veins or arteries; Application antiseptic sol'n; Dressings Puncture; tourniquet; excessive infusion or ↑ circulating blood volume;
Thermoreceptors	Cold, warm	Heat, cold applications; infiltration, extravasation, phlebitis
Nociceptor	Pain	Puncture; dressing removal; infusion irritating sol'n; heat or cold app
Chemoreceptor	↓ Arterial BP stimulates aortic & carotid arteries to respond to O2 & CO2 levels; Blood osmotic changes	↓ Volume of solution = ↓ blood volume. Infusion of hypertonic or hypotonic sol'n

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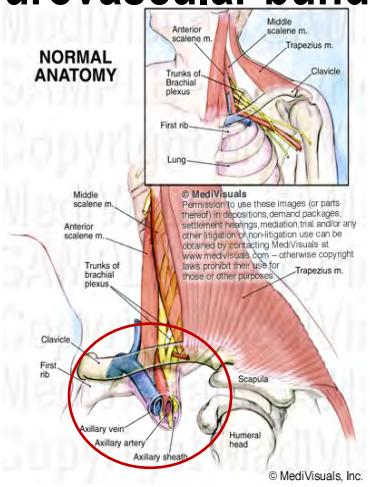
Neurovascular bundle



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- Unless stated otherwise all images are from Karen's personal files
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IV & Infusion Therapy Week 2

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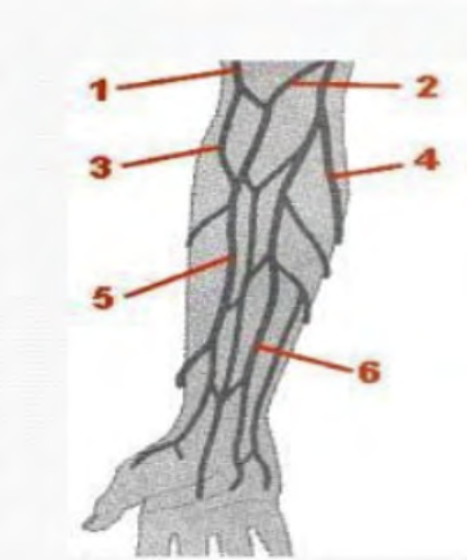
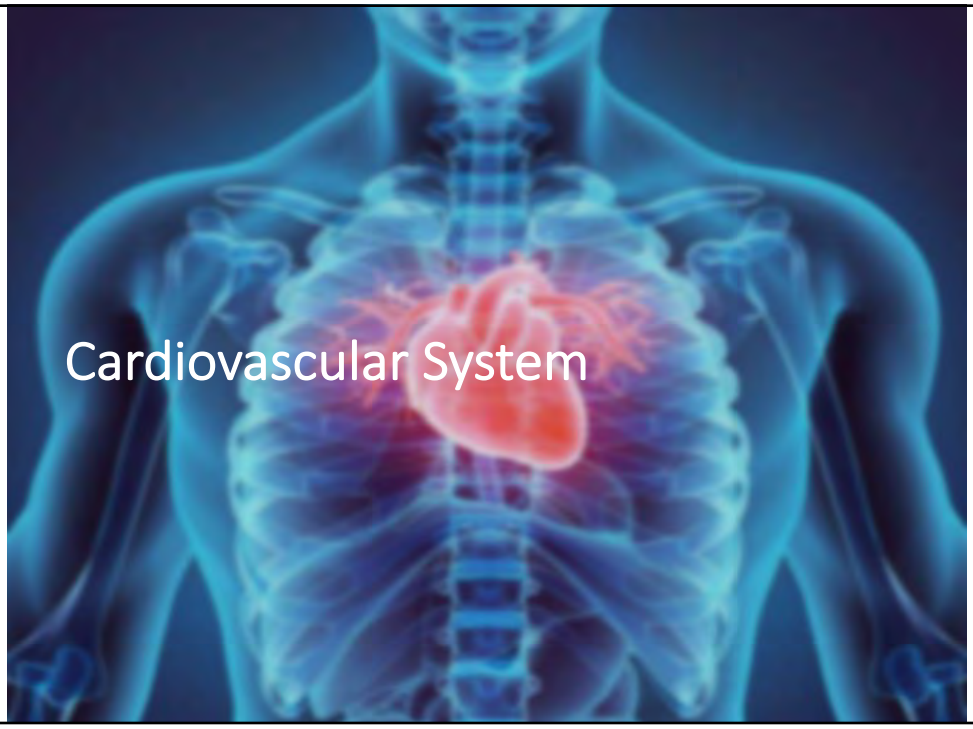
Objectives

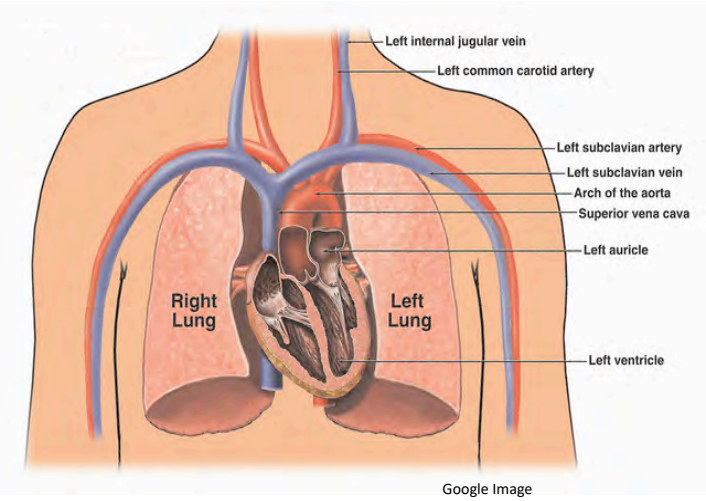
- Identify key difference between artery and vein anatomy
- Name two veins commonly used for peripheral vascular access
- List components of the Cardiovascular System pertinent for Infusion therapy
- Outline the vascular access device process
- Differentiate peripheral devices and central devices
- Summarize the key components of vascular access device selection

Name the vein





Heart, Mediastinum



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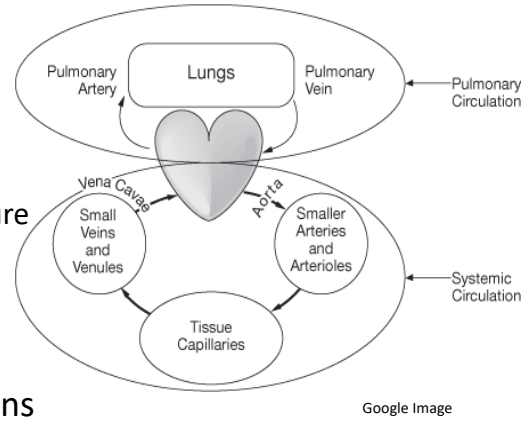
Circulatory System

- Divided into 2 main systems: Pulmonary & systemic
- Systemic veins are classified into 3 classes:
  1. Superficial—venipuncture
     - Where are superficial veins located? (superficial fascia)
  2. Deep
  3. Venous sinuses
- Superficial and deep veins unite—especially in lower extremities



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Mechanisms of venous return

- Pressure gradients
  - 7 -13 mmHg venous pressure towards the heart
    - Venules (12 -18 mmHg) to CVP (~5mmHg
      - This is why calf pump is so important!)
- Gravity drains blood from head and neck
- Muscle pumps
- Thoracic pump
  - Inhalation: thoracic cavity expands (↓ pressure), abdominal pressure ↑ = forces blood upward
  - Blood flows faster with inhalation (consider consequence with COPD patients)
- Cardiac suction of expanding atrial space

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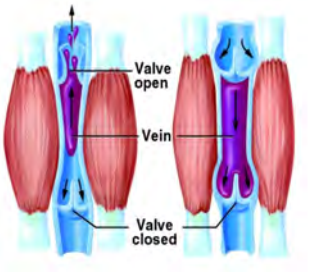

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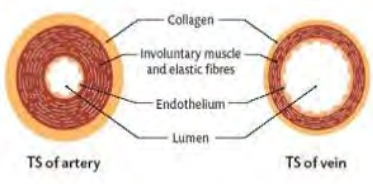
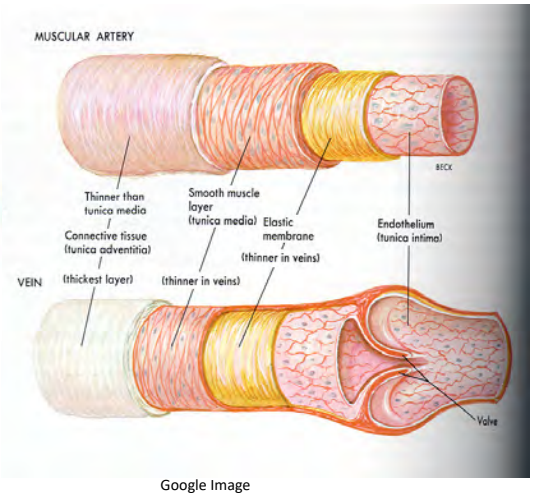
Anatomy of Artery & Vein





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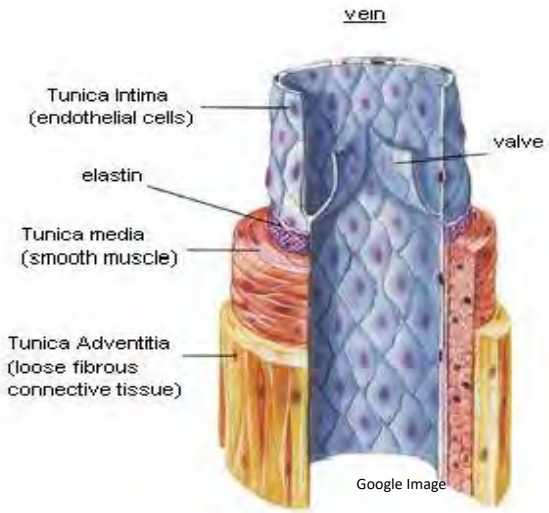
Vein Anatomy and Physiology



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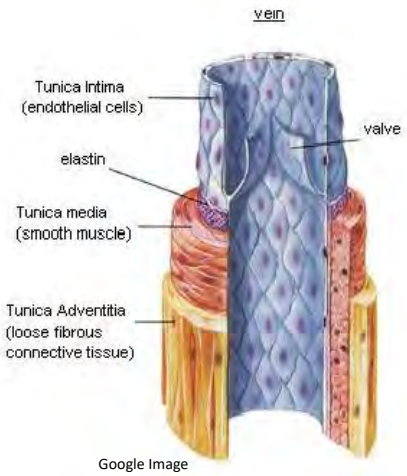
Tunica Adventitia
the outer layer of the vessel

- Connective tissue
- Contains the arteries and veins supplying blood to vessel wall (Vasa vasorum) [may penetrate to the tunica media], lymph channels
- Afferent and sympathetic nerves



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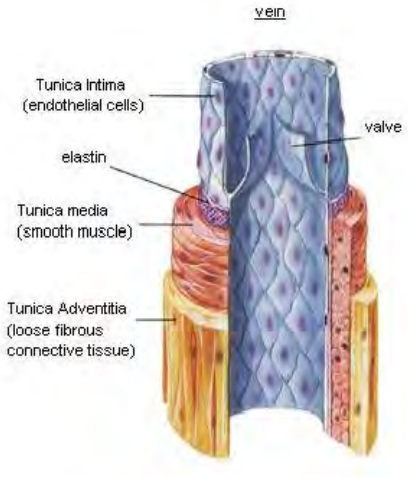
Tunica Media
the middle layer of the vessel

- Contains nerve endings and smooth muscle fibers
- The vasoconstrictive response occurs in this layer

- Patient c/o pain means damage has extended through the inner layer



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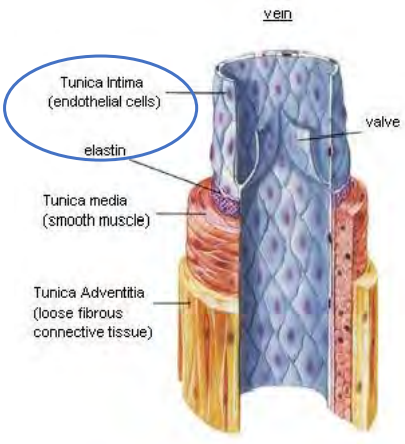
Tunica Intima
the inner layer of the vessel

- One layer of endothelial cells
- No nerve endings
- Surface for platelet aggregation
- w/trauma and recognition of
- foreign object at this level

- PHLEBITIS and THROMBOSIS begins here



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Valves
present in MOST veins

- Prevent backflow and blood pooling
- More in lower extremities and the longer vessels
- Vein dilates at valve attachment

- Occur at branching
- May cause a noticeable bulge in the vein
- If IV started too close to the valve may have false reading of no blood return).

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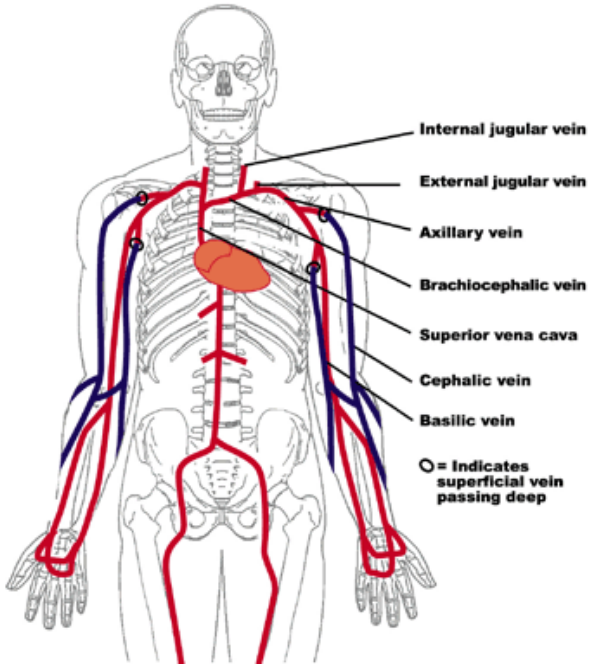
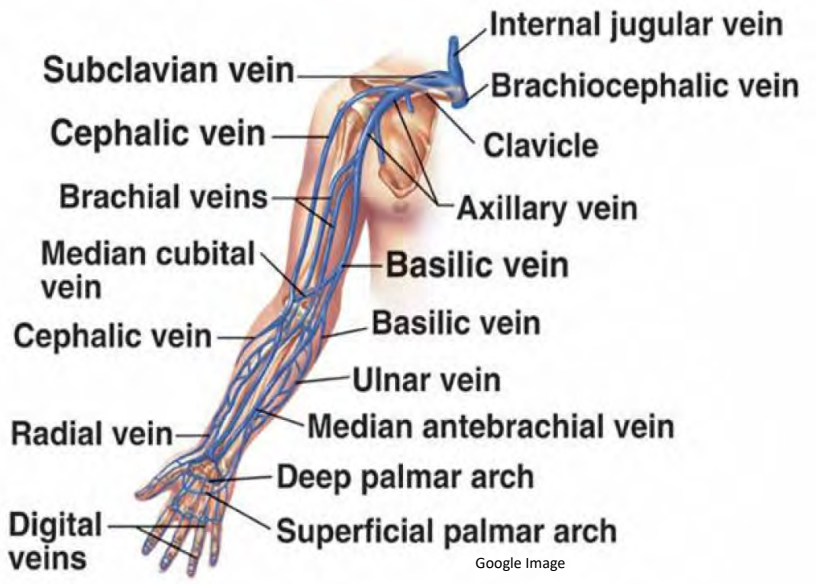
© Copyright Fresenius Kabi AG



Courtesy of Bard™

Veins of Arm and Shoulder



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Veins of the Upper Extremities

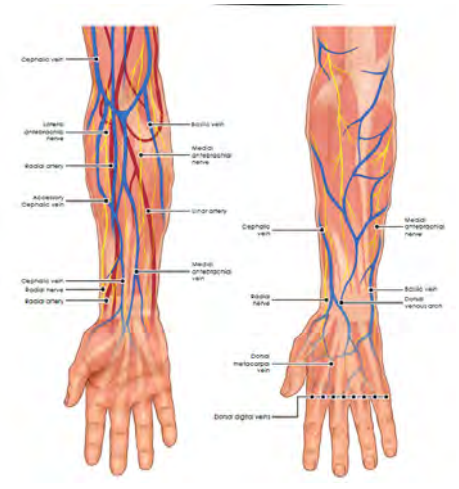
- **Cephalic Vein**
- Begins at radial aspect of wrist
- Access anywhere along entire length

- **Medial Cephalic Vein**
- Joins the Cephalic below the elbow bend

- **Basilic Vein**
- Originates from the ulnar side of the metacarpal veins and runs along the medial aspect of the arm.

- **Medial Basilic Vein**
- Empties into the Basilic vein running parallel to tendons, so it is not always well defined.

- **BEWARE of Radial Artery/Nerve**
- **10 cm from wrist for insertion**



CVAA Resource Centre

Peripheral vascular access devices are ubiquitous in healthcare and risk of harm is significant

Following evidence-based practices will help protect patients from infection.

VADs

Peripheral	Central	Special
Over-the-Needle Short & Long length	Non-tunneled	Dialysis
Butterfly	Tunneled	Apheresis
Extended Dwell	Implanted	Umbilical
Midline	PICC	Intraosseous
Arterial		Hypodermoclysis

PVADS

- Approximately 75 % of all Intravenous Access devices inserted are peripheral
- Catheter, less than 3 inches (7.5 cm) in length
- Over-the-needle catheter is most common

- Gauge sizes 14- 27
- Winged/ non-winged
- Single or double lumen
- Over the needle catheter
- Terminates in a peripheral vein

PVAD

PVAD

- Tip terminates in a peripheral vein
- Any catheter whose tip is not in the bottom 1/3 of the superior vena cava (or is considered a peripheral VAD

Example- Tip position in the Subclavian vein

Courtesy K. Laforet

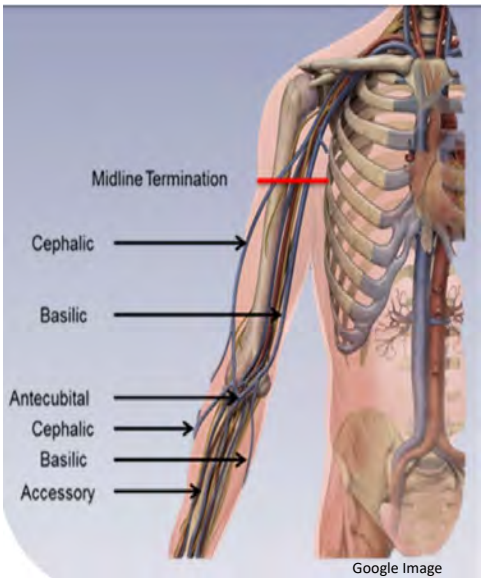
PVAD: Midline Catheters

PVAD's with the tip terminating in the Basilic, cephalic or brachial vein distal to the shoulder—level with axilla

- Single or double lumen
- 1.9 Fr - 5 Fr (adults); 22-24 g for pediatric catheters
- Polyurethane or silicone material

Initiated above or below the Antecubital Fossa in one of the following

- Basilic
- Cephalic
- Median Cephalic
- Brachial Veins



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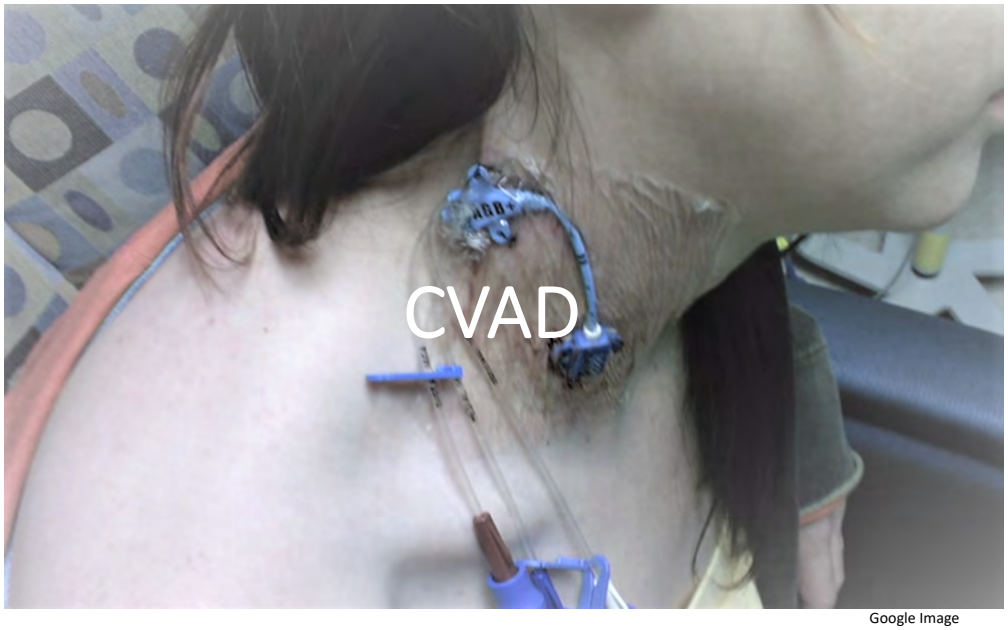

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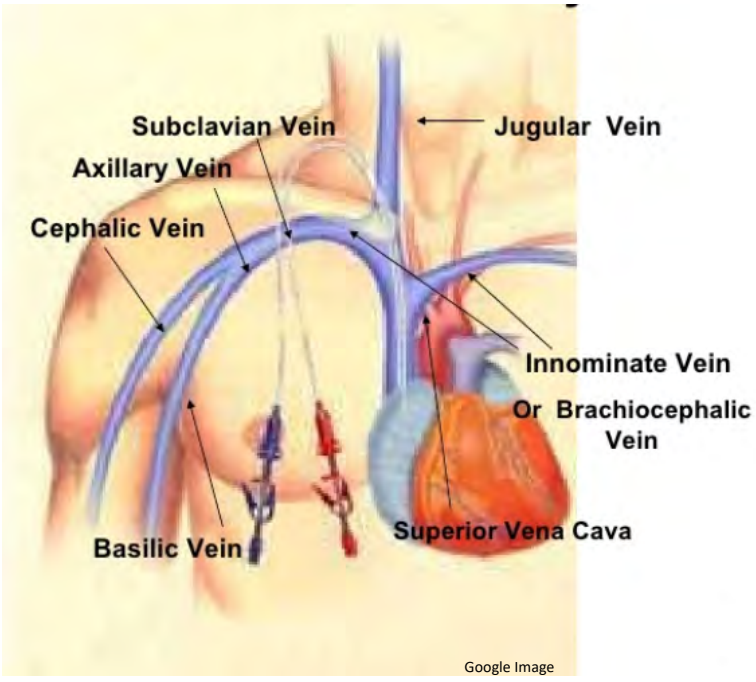

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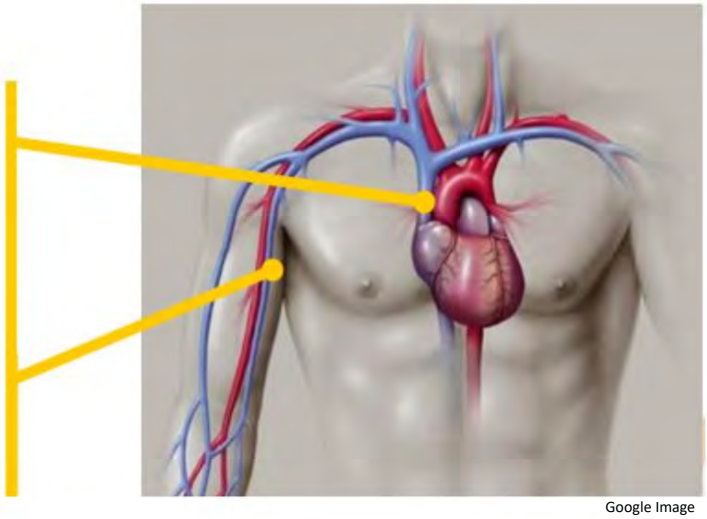
CVAD Tip Location

- Ensure optimal tip location for CVADs [IC]
  - In **distal superior vena cava (SVC) or cavoatrial junction** (CAJ); if using CXR, measure from carina, trachea-bronchial angle, or thoracic vertebral bodies [IB]
  - Femoral VAD should have tip location within the inferior vena cava and above the level of the diaphragm.

1. **PICC**
2. **Midlines / Peripheral Cannulas**



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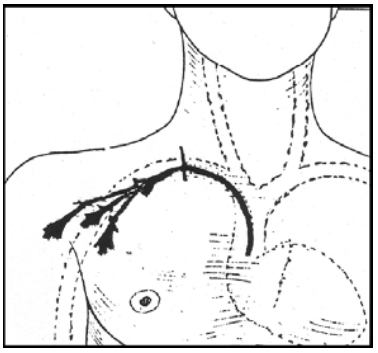
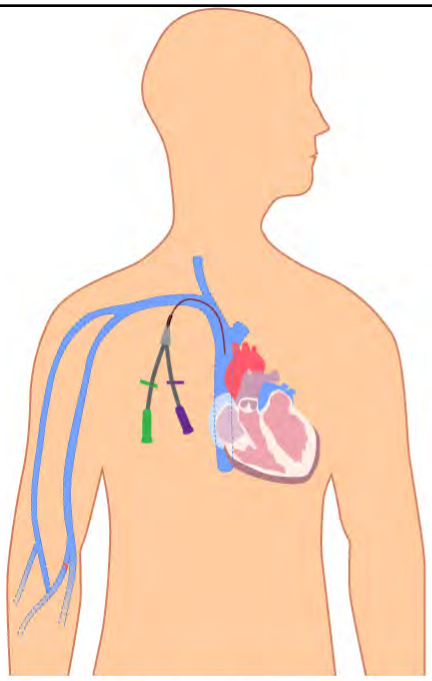
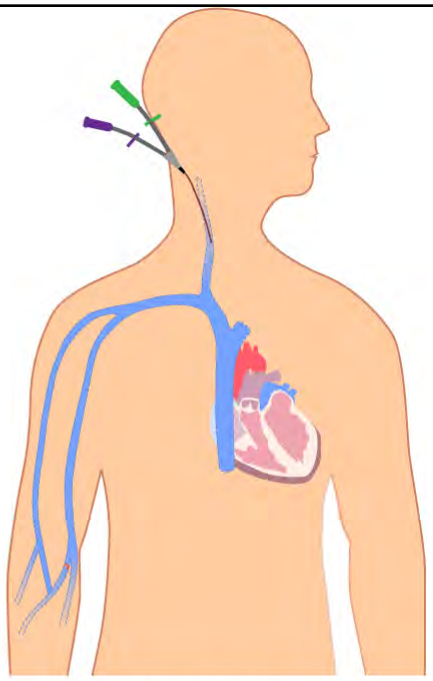
Non Tunneled Catheters

- Recommended for short-term access to the central circulation in critical situations, or when peripheral access is inadequate or inappropriate.
- Used mainly for ICU/CCU patients. Not safe for alternate care settings
- Percutaneous insertion of catheter into the IJ, subclavian or femoral site
- Associated with high risk of CRI d/t skin exit pint of catheter in close proximal to the entry point of vein used
- Available in single, double, triple, quad or 5 lumen
- Generally open-ended.





Subclavian vein insertion



Internal jugular vein insertion

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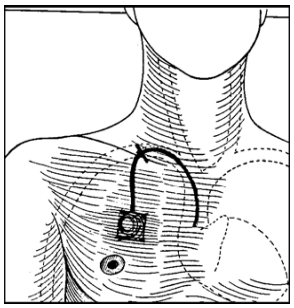
Implanted Devices (aka “Port”)

- An implanted reservoir generally placed in the chest or arm, attached to a catheter with tip position in the central vasculature.
- Infusate is delivered to the reservoir via an external non-coring needle and extension tubing

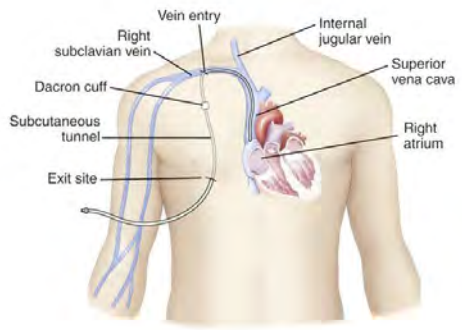


Shutterstock

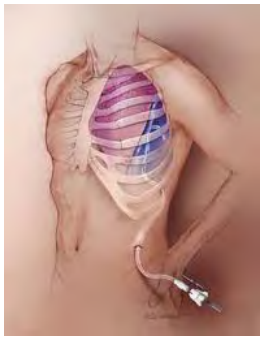
Implanted Devices

- Requires a minor surgical procedure for placement and removal.
- When not in use, requires less maintenance than other VADs.
- Medication delivery requires injection through skin using a non-coring needle
- Intended for long term therapy up to 5 years
- Q 6 -12 week flush with 0.9%NaCl for maintenance (Heparin may be ordered)
- Implanted devices with or without valve

Tunneled Catheters



- Requires surgical placement.
- Cuff secures catheter in place, and prevents bacteria from migrating into the bloodstream



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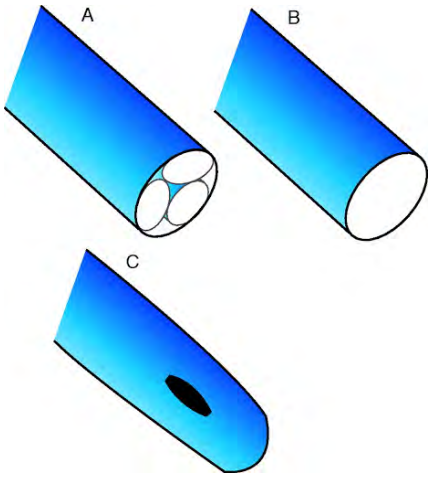
Central Tunneled Catheters

- Intended for long term therapy > 30 days
- Valved (e.g. Groshong) Catheters- saline only flush
- Open ended (e.g. Hickman) catheter
  - Flush with 10 cc Saline & locked with 100unit per mL Heparin
  - Lock with positive pressure technique using clamp

Valved vs Non-valved catheters

- Non-valved VAD: open-ended tip; lumen hub has clamps on external portion of catheter to stop backflow
  - For IVAD: refers to device not having an integrated valve
- Valved VAD: integrated valve
  - Valve located at catheter tip (distal end) or in the catheter hub (proximal end)
  - Valve opens with infusion or flushing and when pressure is exerted for aspiration or blood sampling
  - Valve is neutral or remains closed when no pressure is applied
  - Prevents blood coming into the catheter

Valved vs non-valved



Hemodialysis VAD

- Tunneled or implanted VAD; AV fistula, or insertion of arteriovenous graft:
  - All considered surgical procedures
- Administering meds, solutions through any hemodialysis device requires specific MD order
- Can a nurse remove one of these devices? Yes: if validated competency
- Venipuncture is not to be performed on the extremity containing AV fistula or graft
- Vein preservation KEY for patients who are likely to need vascular access for hemodialysis
- Any access is considered sterile: sterile gloves and mask required
- Can one use PI ointment or Polysporin at exit site? Yes: only if ointment doesn't interact with catheter material as per manufacturer's IFU. ONLY CVAD where ointment is used

Apheresis & Ultrafiltration

- Large bore central catheter, percutaneously or surgically placed to maintain high flow rates and accommodate large bld volumes.
- Apheresis: removal of blood plasma from the body by withdrawal of blood
- Separates into plasma and cells
- Cells reintroduced
- Used to remove antibodies in treating autoimmune diseases
- Tip of catheter resides at junction of SVC and R atrium
- Ultrafiltration: removes excess salt and water in patients in fld overload (e.g. CHF)

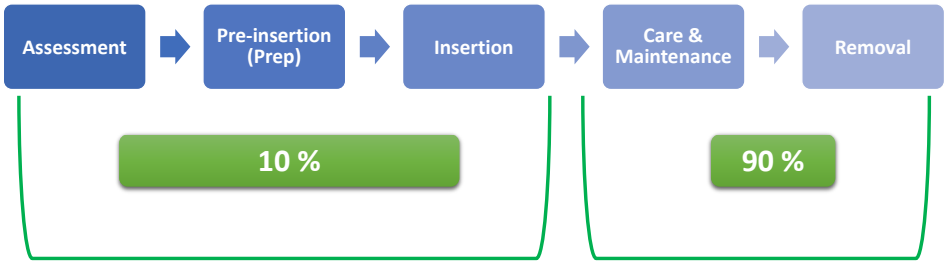
Umbilical Catheter

- Arterial or venous access for newborns
  - Arterial umbilical catheter tip is located in the descending aorta above the level of diaphragm and below the L subclavian artery
  - Venous umbilical catheter tip: located in inferior vena cava above the level of diaphragm
  - Removal: performed aseptically, slowly over several minutes; manual compression with sterile gauze until hemostasis
  - Monitor site X12 hrs then daily
  - Complications: bleeding/hemorrhage, air embolism, infection, thrombosis, vascular perforation, peripheral vascular constriction.

Interosseous

- Inject directly into the marrow of a bone.
- Provides fluids and medication when intravenous access is not available or not feasible
- Emergency access:
  - i.e. codes, in the field, pediatrics
- SOP: pediatrics: after 2 attempts use I.O. access and replace within 24 – 48 hours

Life Cycle of a Vascular Access Device (VAD)



J. LeDonne, 2018

VAD Selection (CVAA, 2019)

- Determine the appropriate type of VAD:
  a) Use device with minimum number of lumens
  b) Always select the smallest gauge catheter that will accommodate the prescribed therapy
  c) Consider use of a 22-gauge PVAD for most infusion therapies.
  d) Consider using longer length PVAD for insertion with ultrasound

VAD Access Site Preparation

College of Nurses Standards

- MD order required to place a device

- Nurse shall be competent in:
  - Insertion technique
  - Infection prevention measures
  - Identifying potential complications
  - Implementing nursing interventions

Primary Goal

One patient
One stick
One device

Google Image

VAD Planning (CVAA 2019)

1. Use a systematic process to develop a patient-centric vascular access plan prior to or at onset of therapy that optimizes vessel preservation and guides device selection.
2. 2. Ensure VAD planning is an ongoing process throughout treatment.
3. 3**. Determine**: is vascular access is necessary or if an alternate route is appropriate (e.g., oral, sublingual, inhaled, nasal, transdermal, topical, subcutaneous)

4. **Select** the device that is the least invasive for the duration and type of therapy and promotes vessel preservation.

Principles of site selection

- Catheter/Vein Ratio
- Hemodilation and hemodilution (Dilution of infusate)
- Vessel preservation
- Location
  - When would you use the hand vs the forearm? (there are exceptions)
    - A TRUE emergency (person is to die in the next 90 sec)
- Just because the vein is large doesn't mean you put in a large cannula

"If you want an IV to fail, put it in the elbow or the hand"

(J LeDonne)

Device Selection (CVAA 2019)

Determine the appropriate type of VAD:

- Always select the smallest gauge catheter that will accommodate the prescribed therapy
- **Consider use of a 22-gauge PVAD for most infusion therapies.**
- Consider using longer length PVAD for insertion with ultrasound

Determine vascular access needs according to:

a) Intended frequency and duration of therapy
b) Prescribed therapy (e.g., osmolarity, pH, vesicant, and irritant properties)
c) History of vascular access and comorbidities (e.g., renal status)
d) Age and developmental stage
e) Anatomy
f) Activities
g) Skin integrity
h) Patient's preferences and lifestyle
i) Available resources for VAD care and maintenance.

- Identify risks and benefits associated with each type of VAD
- Determine the minimum number of lumens required for the plan of care
- Determine if a VAD designed with power injection capabilities is needed

(CVAA 2019)

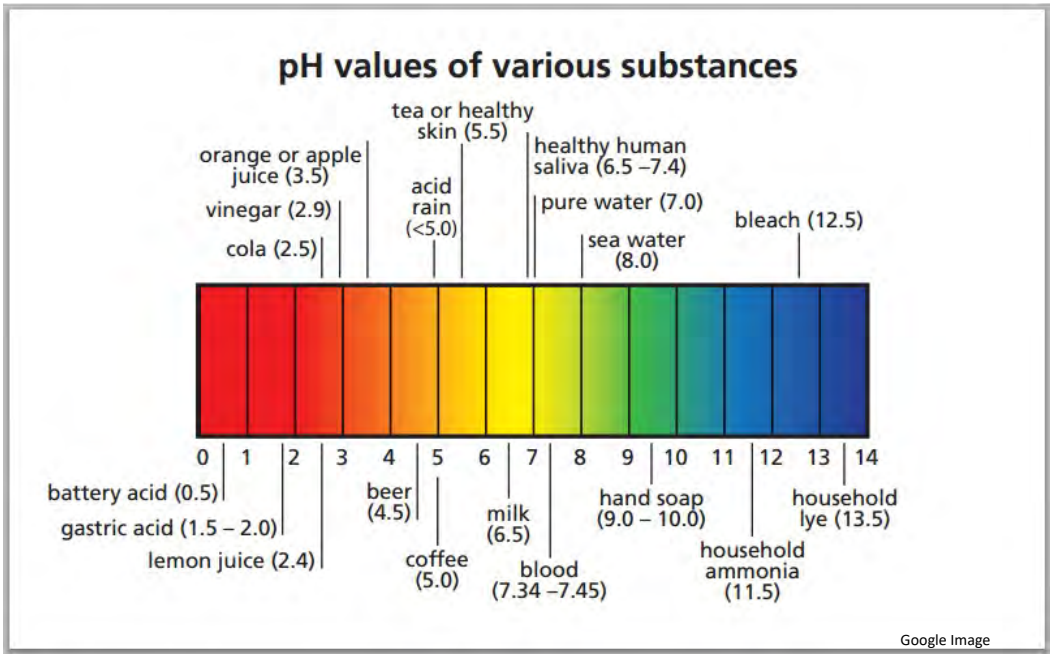
pH Scale

- Measures concentration of hydrogen ions (H+) in a solution.
- 0 to 6 being acidic,
- 7 neutral
- 8 to14 being alkaline (base)

What is critical to understand is that a small change in pH results in a large change in H+ ion concentration.

- pH - Blood pH = 7.35 – 7.45
- **pH of 5 – 9 minimizes disruption of venous endothelium**

- **Medications & IV fluids with a pH of 5-9 can be safely administered via peripheral IV**



Acid pH Scale for common Medications

Acid

- Stomach Acid **pH 1**
- Lemon Juice **pH 2**
- Vinegar **pH 3**

Neutral

- Tap Water **pH 7**

Drug/Fluid

Vancomycin **pH 2.4**

Ciproflaxin pH **3.3-4.6**

Tobramycin pH **3-6.5**

Erythromycin **pH 6.5-7.7**

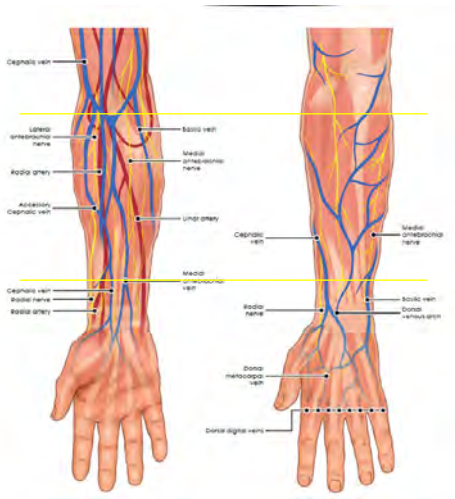
Ceftriaxone **pH: 6.5 - 7**

CVAA Guidelines 2019

Type of VAD	Selection Recommendations
PVAD	• Accessible peripheral veins in the upper extremity for duration of therapy (INS, 2016; RCN, 2016) [IC] • Short term duration of therapy (e.g., < 7 days) [ICVAA] • Osmolarity of continuous solutions and/or medications < 600 Osm/L for short-term duration (e.g., < 7 days) (exception: immunoglobulin) [ICVAA] • Extremes of pH; use with caution [ICVAA] • Intermittent vesicants/irritants. Ongoing clinical assessment needed for sequential or cyclical vesicants/irritants [ICVAA] • Monitor for vein depletion and repeated failed peripheral access [ICVAA]
Midlines	• Accessible peripheral vein in the upper extremity above antecubital fossa (ACF) (INS, 2016; RCN, 2016) [IC] • Duration of therapy < 4 weeks (INS, 2016; RCN, 2016) [IB] • Osmolarity of continuous solutions and/or medications < 900 Osm/L for short-term duration (e.g., < 7 days) [ICVAA] • Extremes of pH; use with caution [ICVAA]
CVAD (non-tunneled, PICC, tunneled, implanted vascular access device (IVAD))	• Suitable peripheral access is unavailable (INS, 2016) [IC] • Consider implanted or tunneled CVAD for long term therapy (epic3, 2014; INS, 2016) [IIC] • Osmolarity of solutions and/or medications > 900m/L (e.g., parenteral nutrition) (INS, 2016) [IC] • Continuous vesicant infusion > 60 minutes [ICVAA] • Consider long-term intermittent vesicant infusion (INS, 2016) [IC] • Consider CVAD for irritant infusions > 60 minutes or ongoing intermittent infusion [IICVAA]

Site Selection

- Veins on Dorsal & Ventral surfaces of Upper Extremities
  - Metacarpal
  - Cephalic
  - Basilic
  - Median Veins
  - Distal Areas – of arms
- Avoid use of radial veins - Potential risk for nerve damage if fluid goes interstitial
  - Painful Insertion



D0 Not Use:

i. Areas of flexion (e.g., wrist, ACF), except in trauma or emergency situation (to avoid nerve damage and depletion of antecubital veins)

ii. Chest wall, digits, or breast

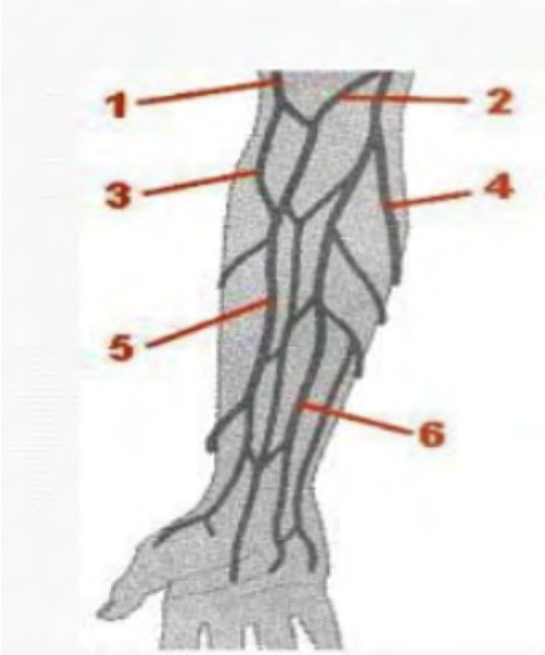
iii. Lower legs, except in non-walking children

iv. Insertion areas that are painful on palpation or with veins that are obviously compromised (e.g., thrombosis, redness, cording, bruising, infiltration, phlebitis, engorgement)

v. Extremity with arteriovenous (AV) fistula/graft site

vi. Affected extremity after extravasation for subsequent VAD insertion until symptoms are resolved (RCN, 2016).

1. Cephalic
2. Median Cubital Vein
3. Accessory Cephalic Vein
4. Basilic Vein
5. Cephalic Vein
6. Median Ante Brachial Vein



Health Leadership & Learning Network
York University Faculty of Health

IV & Infusion Therapy Week 3

Karen Laforet MClSc, RN, CCHN (c),
VA-BC™, CVAA (c)

Objectives

- List potential complications that may occur when a VAD is in situ (PVAD or CVAD)
- Identify prevention strategies to reduce risk of complications
- Discuss the need for regularly or routine VAD observation
- Differentiate infiltration from extravasation
- Explain the role fibrin places in VAD occlusion
- Describe steps to assess and manage complications

Case Study

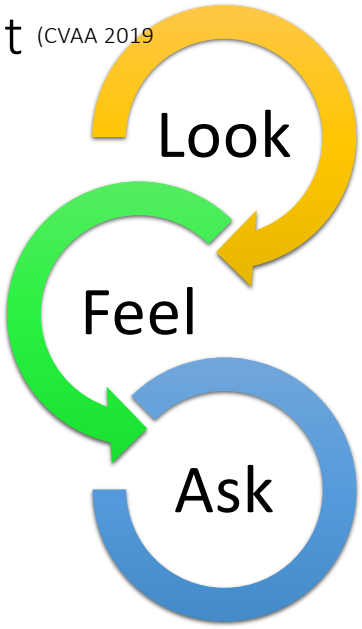

Courtesy K. Laforet

- 89 yrs old male admitted from ER to Orthopedic Unit with a fractured L hip following a fall.
- #20 gauge IV catheter—inserted into L forearm (L arm edematous--etiology unknown)
- Film dressing with border intact. Small amount of sanguineous drainage noted under dressing
- Several pieces of tape secure the IV tubing on underside of arm
- Skin tear post tape removal

VAD Assessment O.P.A.L. 2018

- **O: Observe** fluid container, infusion system, insertion site
- **P: Palpate** the insertion site for changes in temperature, erythema, tenderness or firmness along the vein
- **A: Aspirate** for free-flowing blood return that looks like whole blood (robust blood flow)
- **L: Listen** to the patient concerns and symptoms.

VAD Site Assessment (CVAA 2019



Reasons why VADs Fail


Dislodgement


Patient Interference


Occlusion


Infiltration


Phlebitis


Infection


Catheter Migration

Possible VAD complications

- Phlebitis
- Infiltration
- Extravasation
- Embolism
- Blood vessel damage
- Thrombosis
- Nerve injury
- Infection
- Catheter migration

Phlebitis

- Definition: inflammation of one or all three layers of the vein wall.
- Causes:
  - Mechanical
  - Chemical
  - Bacterial
- Signs and symptoms
  - Erythema
  - Swelling
  - Pain
  - Tenderness
  - Induration
  - Warmth
  - Cording
  - Red streak

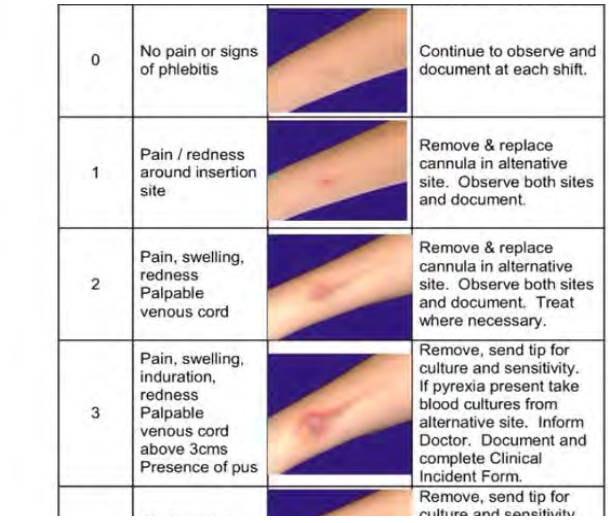
Phlebitis Scale

Grade	Clinical Criteria
0	No symptoms
1	Erythema at access site with or without pain
2	Pain at access site with erythema and/or edema
3	Pain at access site with erythema; Streak formation; Palpable venous cord
4	Pain at access site with erythema; Streak formation; Palpable venous cord >1 inch in length; Purulent drainage

Visual Infusion Phlebitis Score

VIP Scale

NHS



Prevention

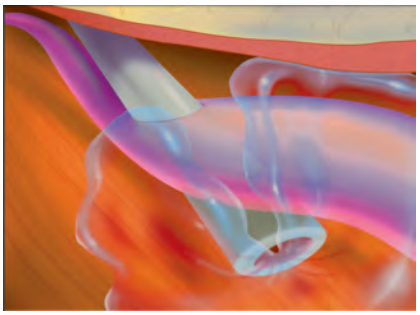
- Medication
- Venous access
- Securement/Movement
- Choosing appropriate devices
- Monitoring VADs closely

Intervention

- Stop infusion at the first sign of phlebitis
  - Determine the etiology of the phlebitis
- Discontinue PIV catheter and restart at a new site or consider alternate mode of delivery
- Apply warm packs
- If discontinuing treatment, ensure patient is educated on after-care

Infiltration

- Definition: Inadvertent administration of IV fluids (non-vesicant) into the surrounding tissue
- Causes:
  - Catheter placed in area of flexion
  - Dislodgement of catheter



Nursing 2002,

Infiltration Scale[5]

Grade	Clinical Criteria
0	No Symptoms
1	Skin blanched, edema <1 inch, cool to touch, with or without pain
2	Skin blanched, edema >6 inches, cool to touch, with or without pain
3	Skin blanched/translucent; gross edema>6 inches; cold to touch; mild to moderate pain; possible numbness
4	Skin blanched/translucent; skin tight, leaking, discoloured, bruised, swollen; gross edema > 6inches, deep pitting tissue edema, circulatory impairment, moderate to severe pain; infiltration of any amount of blood product, irritant or vesicant

Prevention & Management

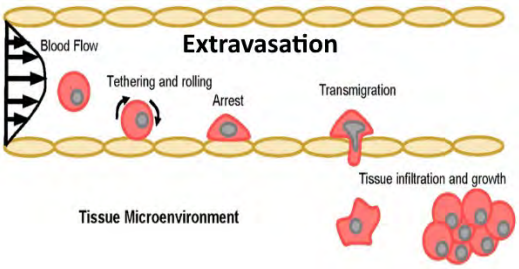
- Selection of appropriate VAD –size & catheter
- Technique
- Securement
- Monitoring

- Stop infusion and remove PVAD
- Warm compress

Extravasation

- Definition: Inadvertent administration of a vesicant medication or solution into the surrounding tissues.
- Causes:
  - Infusion of hyperosmolar or infusate that is acidic, alkaline, vasoconstrictive, or cytotoxic
  - Inadequate securement of VAD
  - Traumatic insertion
  - Multiple venipuncture attempts
  - Small or frail veins
  - PIV site in area of flexion
  - Use of an infusion pump or power injection
  - Presence of a fibrin sheath
  - Dislodged or non-coring needle for ports.

Extravasation



Prevention

- Recognizing the type of medication and its effect as an irritant
  - Example: Acyclovir (pH 10.5-11.6)
- Instruct patient to inform staff of pain and burning at insertion site
- Recognize institutional policies and procedures for administering vesicant medication
- Avoid using the dorsal surface of the hand and areas of flexion where tendon and nerve damage is likely to occur
- Give vesicants last when multiple drugs are ordered

Interventions

- Elevate affected extremity
- Contact physician
- Local thermal application (Cold or heat)
- Documentation
- Antidotes

NON-VESICANT Infusions PVAD[1]

Acute care continuous infusions

- Every 4 hours, alert/oriented
- Every 1 - 2 hours for sedated patients, who are cognitively or sensory impaired or critically ill.

Alternate care settings

- Once a shift or visit
- Instruct patient/caregiver how to assess PVAD every 4 hours while awake and to report any changes immediately

Electronic Infusion Devices

VESICANT Infusions PVAD[1]

- Every **5 – 10 min**—any solution or medication with ↑ clinical risk [(6)]
- Every **≤30 min** for non-chemotherapy vesicants
- Every **2 – 5 mL** confirming blood return for IV push chemotherapy agents

Vesicants

Neonates & Paediatrics[1]

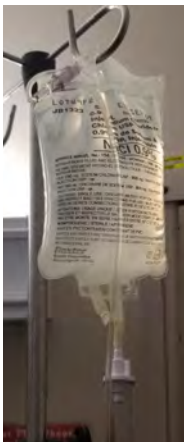
Every 1 - 2 hours or more frequent observation

Common Sources of VAD Contamination


Hand Hygiene


VAD Location


Skin Surface

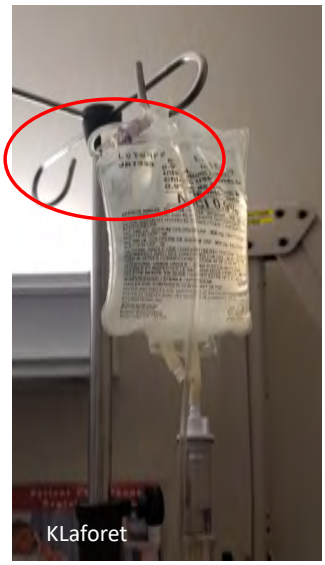

Contaminated Equipment


Idle Catheters


Asepsis breach

Equipment contamination [13, 14]

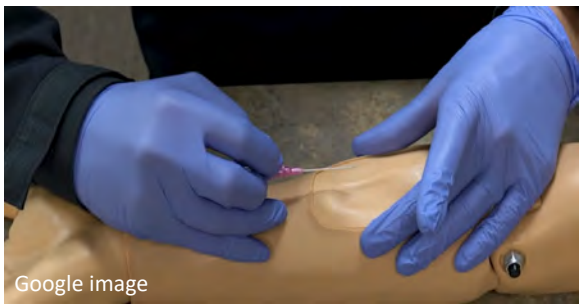
- Touch points include:
  - Catheter hub,
  - Injection ports
  - Administration set
  - Medication/infusion administration



Idle catheters

- Catheters are a nidus for infection due to fibrin build-up
- Increased risk of contamination each time the device is accessed:
- Flushing frequency—ask why so often?
- Contamination at hub or with flush syringe.

Asepsis Breach



PVAD Securement & Stabilization [2,3]

Use 22 ga whenever possible

30% catheter:vein ratio

VAD location

Avoid areas of flexion

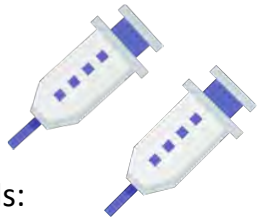
Use sutureless securement to limit VAD movement

Prep skin properly

Visually inspect VAD at regular intervals

Change dressing if soiled, loose or damp

Patency, Flushing & Locking



- Flush VAD and confirm patency at established intervals:
- IVAD (non-accessed/not in use): no more frequently than monthly: consider extending frequency to three months

- Lock all VADs with the sterile preservative-free 0.9% sodium chloride flush using the appropriate technique to maintain VAD patency.
- Aspirate all alternative lock solutions prior to use of the VAD or according to MRP/manufacturer's instructions for use
  - Exception: low-dose heparin (e.g., 10 or 100 units/mL) may be flushed through
  - If unable to aspirate, alternative lock solutions may have to be flushed through (except high-dose heparin, e.g., if therapeutic dose must be flushed through, MRP should be notified).

Aseptic technique [14, 16]

- Asepsis is defined as a process for keeping away disease-producing organisms in sufficient quantity to cause infection
- Whether the procedure is “simple” or complex, the goal for healthcare professionals is to prevent the transfer of pathogens
- Aseptic non-touch technique (ANTT®)

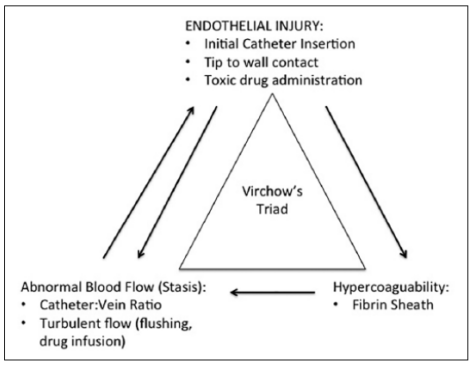
Catheter Related Blood Stream Infection (CRBSI)

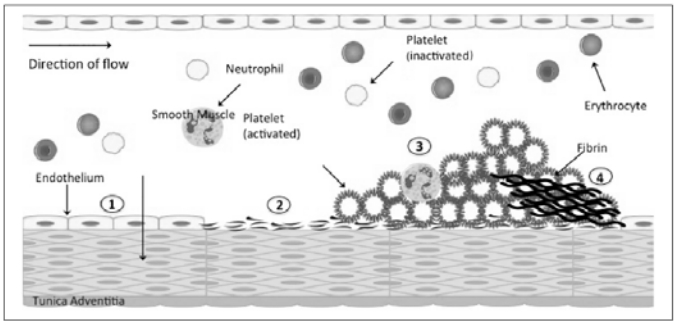
- Interventions
  - Assess for signs and symptoms of CRBSI
  - Examine the patient and carefully rule out other sources of infection
  - Cultures
    - Consider time-to-positivity blood cultures
    - When a sample for blood culture is drawn, the needless connector should be changed prior
    - Draw out blood cultures prior to the initiation of antimicrobial therapy
    - Antimicrobial therapy is based on identified or presumed microorganism

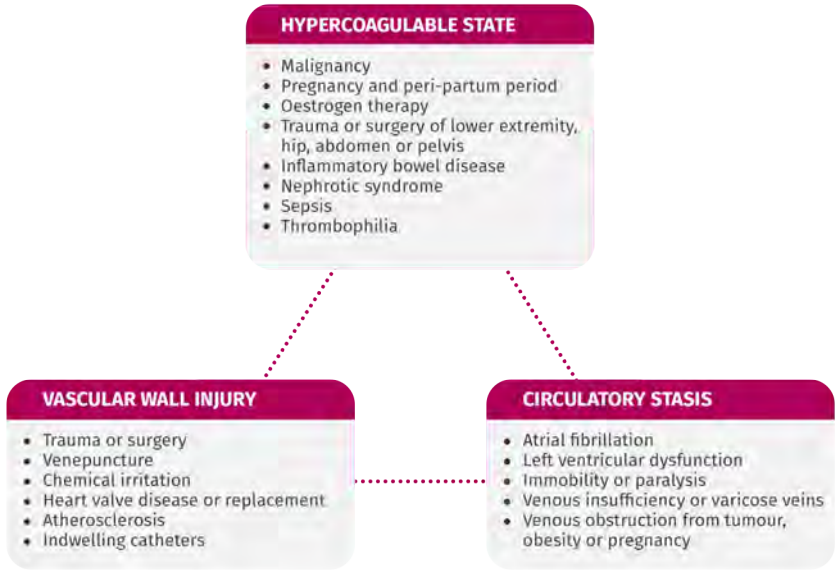
Signs and Symptoms of CVAD Occlusion

- Upon Infusion or Flushing
  - Resistance
  - Sluggish flow
  - Inability to infuse fluids
  - Frequent occlusion alarms on infusion pump
  - Infiltration or extravasation or swelling or leaking at the insertion site.
- Upon aspiration of blood
  - Inability to withdraw blood
  - Sluggish blood return

Thrombosis







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Medical Adhesive-related Skin Injury (MARSI) [2,3,6]

- An occurrence in which erythema and/or other manifestations of cutaneous abnormality (including, but not limited to, vesicle, bulla, erosion, or tear) persists 30 minutes or more after removal of the adhesive."[2]

Moisture Associated Skin Damage (MASD) [7]

- Describes the spectrum of damage that occurs in response to the prolonged exposure of a patient's skin to perspiration, urine, feces, wound exudate etc.
- VAD-associated MASD is related to insertion site leakage or increased moisture due to skin damage

Tension Injury

Allergic Contact Dermatitis

Protect skin [2, 3, 7, 8]

- Antiseptics and adhesives are chemicals that may irritate the skin
- Skin **MUST be clean and dry** before applying any product
- For patients at-risk of skin breakdown, or for patients receiving long-term therapy, apply **skin protectant** prophylactically
- **Alcohol-free product** to reduce xerosis
- VAD application requires **sterile product**
- Avoid water soluble products if exudate or denuded skin
- **Products must be completely dry before applying the dressing**

Air Embolism

- Definition: when air enters the vascular system leading to complications
- Causes:
  - Catheter fracture
  - Disconnection of IV sets
  - Deep inspiration during catheter removal/access device change
- Signs and symptoms
  - Hypoxia
  - Hypotension
  - Pallor
  - Palpitations and arrhythmias
  - Chest and shoulder pain
  - LOC
- Prevention
  - All air purged from syringes, administration sets, needless connectors
  - Clamp open-ended catheters
- Management
  - Position the patient in left lateral Trendelenburg
  - Administer Oxygen

Health Leadership & Learning Network
York University Faculty of Health

IV & Infusion Therapy Week 4

Karen Laforet MClSc, RN, CCHN (c),
VA-BC™, CVAA (c)

Objectives

- Differentiate fluid balance in adult, older adult, paediatric populations
- Describe infusion therapy and name three types seen in your care setting
- Identify a critical safety step when infusing blood or blood products
- Explain the difference between primary and secondary infusion and safety considerations for both
- Name five ways pediatric patients differ from adults specific to vascular access insertion
- Discuss medication safety considerations for older adults

Agenda

- Infusion solutions
- Paediatric Considerations
- Older Adults
- Aseptic Technique
- Infusion Complications
- Transfusion
- TPN
- Documentation guidelines

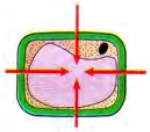
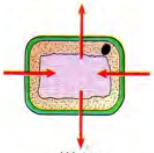
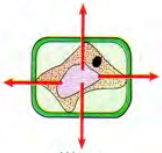
Health Leadership & Learning Network

Definition of IV infusion

- Regarded as an amount of fluid in excess of 100mL designated for parenteral infusion because the volume must be administered over a long period of time
- Solution is defined by the USP as a liquid preparation that contains one or more soluble chemical substances usually dissolved in water.
- Solutions are not intended for admin by infusion or injection

Characteristics and Types of IV Fluids

- Fits into three main categories
- Isotonic
- Hypertonic
- Hypotonic

	Hypotonic	Isotonic	Hypertonic
Description	• A solution which has less solutes than another solution.	• A solution which has the same amount of solutes with another solution.	• A solution which has more solutes than another solution.
Effect on animal cell	• Water enters the cell. • Cell expands and may finally bursts (Condition known as haemolysis if involves red bood cells).  Water	• Water molecules move in and out of the cell at same rate.  Water	• Water moves out of the cell. • Cell shrinks (crenation).  Water
Effect on plant cell	• Water enters the cell. • Cell becomes very turgid.  Water	• Water moves in and out of the cell at the same rate. • Cell is turgid (normal).  Water	• Water moves out of cell. • Cell becomes flaccid (plasmolysis).  Water

Infusion Therapy for Dummies 2017

Isotonic Solutions

- Examples:
- Lactated Ringers (275 mOsm/L
- 0.9%NaCl
- 2.5% dextrose/0.45% sodium chloride
- 5% dextrose and water
- Normosol® 3
- Plasmalyte® A
- Plasmalyte® R
- Isolyte® • E · Ringer's

- ECF fluid replacement--dehydration
- Treating metabolic acidosis
- Sodium depletion
- Initiating and terminating blood infusions
- Closely monitor for fluid overload
- Liver converts lactate to HCO3 so do not infuse in someone with pH>7.5
- 5%DW after admin, dextrose is quickly metabolized leaving only water (hypotonic). Monitor for fluid overload

Hypertonic Solutions

- Osmolarity is **>300 mOsm/L** (higher than solute concentration in serum)
- Exerts more osmotic pressure than ECF.
- When used fluid is pulled from the cells and interstitial compartment into the blood vessel.
- E.g. Blood cells placed in a hypertonic solution will lose water to the solution (to balance solute concentration) therefore cells will shrink.
- Patients receiving hypertonic solutions need to be monitored closely for fluid overload.
- Used post-op to ↓ risk of edema, stabilize BP, regulate urine output
- Examples:
  - 3 – 5% NaCl
  - 10 – 20% Dextrose in Water
  - 5% Dextrose in Lactated Ringers; 5% Dextrose in 0.45% NaCl
  - 10% Dextrose and 0.45% NaCl
  - 5% NaBicarb injection; 10 -15% Mannitol

Hypertonic Solutions

- Administer with great caution to prevent pulmonary edema
- Infuse hypertonic NaCl solutions slowly—e.g 200 mL over a minimum of 4 hours
- Careful to prevent infiltration and trauma to the tissues
- Should only be used in critical situations (Na: <110 mEq/L) with neurological symptoms
- Administer in controlled setting like ICU
- Only small volumes needed for correction
- Use pump to control infusion

Hypotonic Solutions

- Osmolarity **< 280 mOsm/L** (lower concentration than serum)
- Exert less osmotic pressure that fluid in the ECF therefore water is drawn from the ECF.
- Fluid shifts out of blood vessels into the cells and interstitial spaces
- Blood cells placed in a hypotonic solution will draw the solution into the cells (causing swelling and bursting).

Hypotonic Solutions

Examples:

- 0.45%NaCl (154 mOsm/L)
- 0.33%NaCl (103 mOsm/L)
- 2.5%DW (126 mOsm/L)

- Administer cautiously
- Causes a fluid shift from the intravascular (Bld vessel) into the ICF
- Can cause cardiovascular collapse from IVF depletion and ↑ fluid in brain cells
- Do not give to patients at risk of 3rd spacing: burns, trauma, low serum protein, liver disease or malnutrition

Paediatrics

Physical and developmental considerations

- Body circumference changes 3X increase in length and approx. 20-fold increase in weight between birth and adolescence
- Stress level and basal metabolic rates are exceedingly higher than adults

Common reasons for IV therapy

- Maintenance of fld therapy:
  - Younger the child greater risk of fluid & electrolyte imbalance
- Antibiotic therapy
  - Most common reason in Paeds is sepsis
  - Choice of device based on length of treatment and vein availability
- Medication therapy
- Anticancer drugs
- Nutritional support
- Transfusion therapy

Anatomy and Physiology

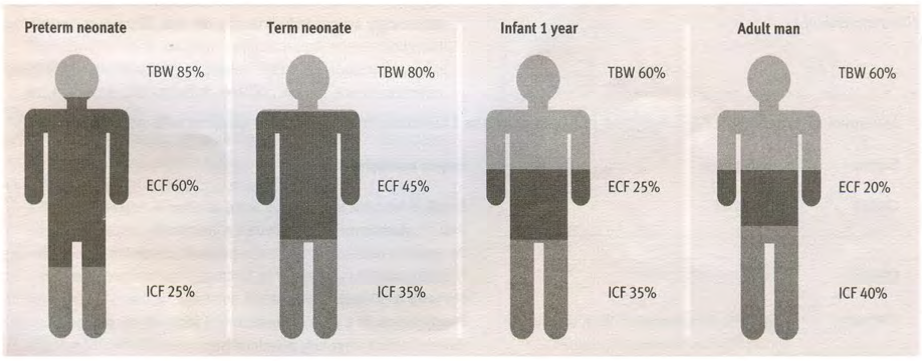
1. Vessel size – smaller- locations the same
2. Circulating blood volume-greater per unit of body wt
   - Neonate: 85-90 mg/ml
   - Infant Child: 75-80 mg/ml
   - Child : 70-75 mg/ml
   - Adolescent: 65-70 mg/ml
3. Fluid and electrolyte metabolism-
   - **↑ amount free water in extracellular space**
   - ↑ Na and Cl ------ ↓ K, Mg and phosphate

Anatomy Physiology (2)

4. Thermoregulation
   - Thin subcutaneous leads to ↑ loss of heat- cold stress
   - Loss of heat → hypothermia → ↑oxygen and caloric requirement
   - Keeping baby warm is a priority

5. Renal function
   - May have difficulty dealing with fluid /electrolyte balance
   - Watch for fluid overload d/t hyperosmolarity; happens very quickly

Body composition



Special Considerations

- Neonates: Birth to 4 wks. Can loose fluids quickly
- Infants: 1 to 12 months. Growing quickly
- Toddlers: 12-36 months. Aware of surroundings
- Early childhood: 36 mths-6 yrs. Understands, questions reacts
- School age : 6-12 yrs. growth spurts
- Adolescent : 11-18 years: hormones, emotional development

Considerations

- Neonates and Infants : Involves family in the process
  - Take time to explain using simple terminologies
  - Scalp IVs can be distressing to parents
  - People can think medication is going to the brain
- Toddlers and up: Being in the correct environment
  - Involve parents
  - Room is their safe area consider using designated treatment area
  - Consider sedation if child is too restless or stressed
  - Addressing their curiosity for a better experience, doll with IV in
  - Requires patience and creativity
  - For prolonged therapy consider PICC lines to reduce stress of venipunctures

Considerations (2)

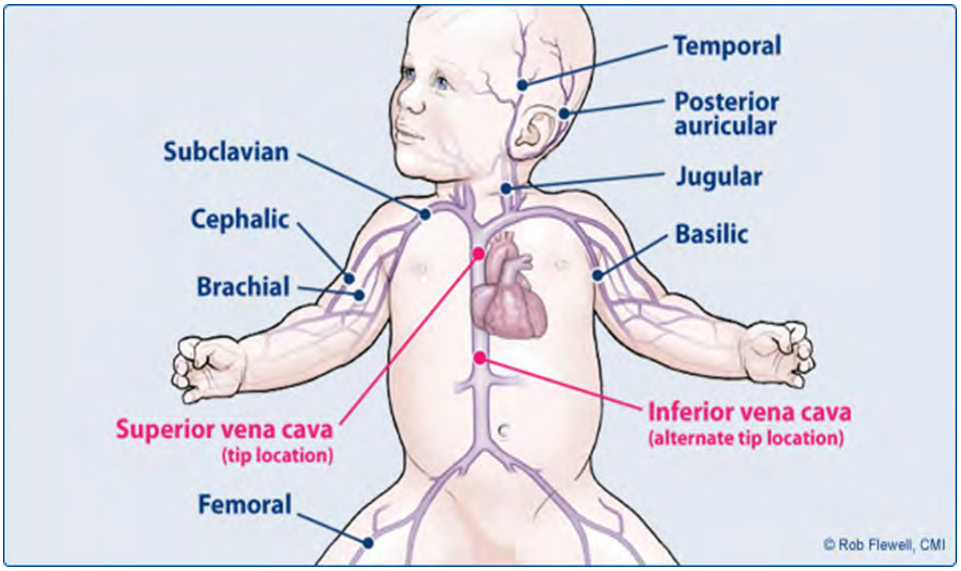
- Detailed attention needed in dosage calculations/infusion rates
  - Smaller vessels require slower infusion to prevent complications like extravasation or infiltration
  - Check infusion site frequently
  - Smaller catheters require more frequent flushing
  - Monitor output
- Body height and weight very important in calculation of dosages
- Choose the correct equipment
  - Correct gauge and sized needles
  - Chlorhexidine is not considered appropriate for use in children under 2 months
  - Immobilizing the limb
  - Topical anesthetic
  - Warm packs

Types of Vascular Access

- PIV: short term and easily dislodged
  - Over the needle catheters 27-19 gauge < 2”
  - Midlines
- Intraosseous
  - If 2 unsuccessful attempts or circulatory collapse
  - Must be changed within 24 – 48 hrs.

	Advantages	Disadvantages	Veins
Non-Tunnelled CVC	For short term emergency Tx in critical care. No needle sticks involved. Lower rates of infections in Paeds than adults	High risk of infection if access is proximal to diaper area. May be difficult to access in infants due to significant superior arch of the subclavian vein	Internal Jugular Internal Subclavian Femoral veins
Tunnelled CVC	Lumens larger than PICCS=more fluid volume. Less risk of infection than Non-tunnelled CVC. Easily accessed for care by patient and family	At risk of accidental removal, if child is very active. Insertion procedure is invasive and requires anesthesia	Tunneled via internal jugular veins and subclavian, exits in the chest
Peripherally Implanted Central Catheter	No needle stick involved in insertion. Less invasive, more economical. After care is easier	Higher infection rate in neonates than in children, contraindicated in patients with chronic renal failure	Inserted in the basilic, internal jugular, lower extremities (saphenous or popliteal), scalp vein
Implanted Ports	Surgically placed and tunnelled. Lowest risk of infection compared to other CVCs. No external connection to pull Allows for swimming.	Painful during accessing. Ports may be displaced with vigorous activities. Surgically removed	Internal and external jugular as well as cephalic veins
Hemodialysis Catheter	Catheters are large-bore and double lumen for haemodialysis, peritoneal dialysis and renal transplant patients	2single lumen catheters Recommended over 1 double lumen catheter for improved performance	Tunneled via jugular vein, ends in the Rt atrium. Femoral vein feasible as well

Sites—Infants…



Sites

Sites	Pros	Cons	Precautions
Scalp	Veins are: Readily visible, easy to access, no valves. Commonly used in infants and toddlers. Not easily tampered with	Infusion can infiltrate easily May lead to distorted appearance of Infants heads with infiltration Cannula may not be easy to secure	Aim needle downward towards venous return flow. Be aware of family's cultural orientation towards hair shaving and appearance
Foot	More visible in chubby infants, veins readily dilate, hands remain free. Beneficial with children presenting with neuropathy eg spina bifida	Prevents walking High risk of phlebitis Limited sizes of cannula	Though child may not be walking, but may kick often
Upper Extremities	Easily accessible and palpable in older children, use of larger catheters sizes enabled, access to larger veins for increased haem dilution	Increased nerve endings hence more painful Challenging access in chubby children	Childs activities requiring use of hands may be restricted

Sites

Site	Pros	Cons	Precautions
Femoral	Bigger veins Does not have too much bacterial growth	Difficult to maintain due to increased activity of lower limbs in children. Needs limb immobilization	Restraining required
Umbilical	Accessible in neonates and 1 week old in critical situations	Need special training Heavily colonized area	Used only in emergency situations
Intraosseous	Provides immediate access	Need special training	Used only in emergency situations

Complications

- Occlusion
- Thrombosis- congenital heart disease, oncology and GI issues
- Malposition: can lead to endothelial wall injury
- Air embolism
- CLABSI- more common in immunocompromised children
- DVT
- *Phlebitis occurs usually after age 10*

Risks of infusion therapy in Children

- Acidosis related to poor thermoregulation
- Dehydration or over-hydration
- Immature liver results in electrolyte imbalance

Maintenance

- Keep access sites warm
- Keep infants warm
- Avoid use of kling/any wrap over sites for quick and frequent visual assessment
- Use appropriate stabilizers to prevent catheter dislodgement (arm pads, IV house)

Use asepsis for prevention of any and all infections!!!!
NOT just for kiddies!

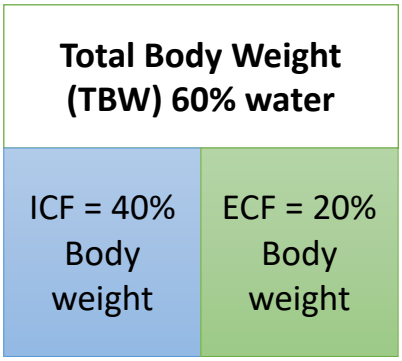
Older Adults

Factors Affecting Skin Characteristics over time

- Increased dryness and wrinkles
- Decreased number of sweat glands, subcutaneous fat & vascularity
- Decreased epidermal turnover
- Vitamin D production is decreased
- Elastin fibres calcify
- Dec vascular network hair follicles and glands
- Shorter capillary loops
- Dec nerve endings
- Decreased skin tugor (lost of mucopolysaccharides—sebum prod)
- Decreased sweat glands and sweat production
- Dec melanocytes = ↓ protection from UV
- Dec mast cells = ↓ histamine release (delayed reaction response)

Where's the water?

- Adult body is approximately 60% water
- Older adults are closer to 40 - 50% water
- Most of body's water is intracellular—especially muscle
  - Aging ↓ muscle mass = bodies contain < water



Dehydration Problem for Older Adults

- Older adults have:
  - **Less muscle = less water**
  - ↓ thirst
  - Chronic dehydration

- Dehydration is difficult

To correct

Chronic dehydration = lose

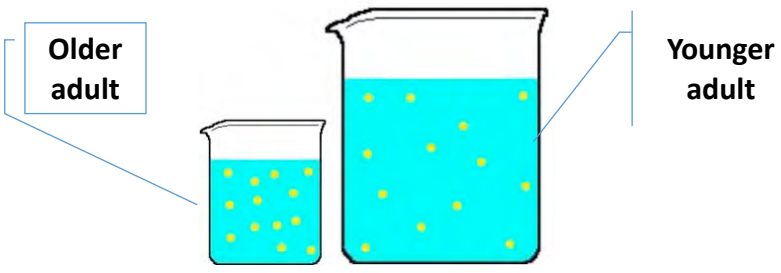
symptoms that tell you are…

Need to identify impending dehydration:

- Lab tests: BUN: Creatinine ratio >25
- Na (↑); Glucose (↑), Bicarb (↓)
- Dry mucous membranes—mouth & nose
- Tongue furrows
- Dry axilla
- Sunken eyes
- Poor skin turgor

What's the risk?

- Less TBW means less drugs are distributed in water (water soluble meds) therefore lower dose is needed in an older adult
- Less water means ↑ risk of dose toxicity



Specific considerations: Vein selection

- Thin skin and loss of subcutaneous fat → mechanical inflammation and infiltration
- If possible select sites with sufficient tissue and skeletal support

Things to remember

- Older adults may not be aware of his or her surroundings; slower to adapt to environmental changes
- They might get tangled, tripped or fall
- Make sure the tubing is not dangling or dragging on the floor

VAD insertion for Older Adults

- Pre-hydration is often necessary before insertion
  - This is important specially with significant loss of fluid or induction of high risk medications that have the potential for irritation
  - This will help prevent intravascular depletion
  - Insertion of the larger VAD will be much easier.

Vein selection

- Assess entire surface of both arms
- Skin condition
- When possible, sites should not hamper older adult performance of ADL
- Site should have sufficient tissue and skeletal support
- Distal sites (first) to preserve future access sites
- Avoid previously used insertion sites; bruised areas
- No larger than 22ga. 24 Ga preferred

Things to remember

- Skin is fragile and delicate → too vigorous scrubbing or pulling action may damage surface skin tissue
- Older skin has lost some natural moisture → excessive use of alcohol may add skin dryness and cracking
- Allow the antiseptic to dry completed (at least 30 to 60 seconds)
- Shaving not recommended → remove hair by clipping

Things to remember

- Considerations with regard to using tourniquet in older adults:
- Avoid excessive distention of the vein

hematoma, bruising

Things to remember

- Amount of tape applied to the skin should be minimized in patient with delicate skin
- Skin barrier can be use to protect skin from the effect of adhesive/drying nature of the antiseptic/ repetitive tape removal and dressing changes

Remember:

Hard and stiff edges of the IV devices can cause older skin to become irritated, sore or can even cause ulceration

VAD Protection & Stabilization

- **Site protection** (e.g., waterproof sleeve, dry garment, plastic dome/protector, mesh sleeve
  - Site protection methods are in addition to primary dressing &securement device.
- **b) Joint stabilization** (ONLY if absolutely necessary—restricts movement of already stiff joints)
- **c) Restraint/physical immobilization device** (e.g., soft device, tie or mitt used to immobilize arm or hand)

Types of blood transfusion

- Allogenic blood transfusion (someone else's blood)
- Autologous blood transfusion (own blood)
- Exchange blood transfusion

IV Access

- Transfusing rapidly and under pressure through too small an IV access can cause destruction of red blood cells. *What is considered "too small"?*

- Ensure that the IV access is dedicated to the transfusion.
  - Medications and solutions other than normal saline can cause hemolysis or clotting of the blood component

- When transfusing through a CVAD with multiple lumens, medications/solutions can be infused through other lumens without damaging the blood component/product.
- IV pumps, blood warmers, and rapid infusers must be suitable for transfusion and not damage the blood component/product.

Practice Guide

- **Follow your provincial standards for blood transfusion**
- **REMEMBER:**
- A blood transfusion is a human tissue transplant.
- Anemia tolerance is based on the assessment of signs and symptoms.
- Provide clinical information related to anemia tolerance when reporting lab values.
- Verify blood products at the patient's bedside according to facility policy and procedure.
- Transfuse *one* unit of RBCs at a time, then reassess the patient.
- Limit phlebotomy and blood loss from lab testing.

IV Access

PRODUCT/COMPONENT	CATEGORY	IV ACCESS
RED BLOOD CELLS	RAPID TRANSFUSION IN ADULTS	20 - 22 Ga
RED BLOOD CELLS	ROUTINE TRANSFUSIONS IN ADULTS	22 – 24 Ga
OTHER BLOOD COMPONENTS		ANY SIZE ADEQUATE
All Blood Components/Products	Pediatrics and Adults	22-25G
All Blood Components/Products	Adults and Pediatrics	Central Venous Access Devices (CVAD)

Acute Reactions - Risk and Description

Acute Transfusion Reaction	Risk of Event	Description
Minor Allergic Reaction	1 in 100	Mild allergic reaction to an allergen in the blood component/product.
Anaphylaxis	1 in 40,000	Potentially fatal reaction caused by an allergen that the patient has been sensitized to. STOP transfusion
Febrile Non-Hemolytic	1 in 300	Mild usually self-limiting reaction associated with donor white blood cells or cytokines in the blood component/product. Usually presents with fever and/or rigors (shaking).

Acute Reactions - Risk and Description

Acute Transfusion Reaction	Risk of Event	Description
Acute Hemolytic Transfusion Reaction	1 in 40,000	Potentially fatal reaction caused by blood group incompatibility. Can also be caused by chemical hemolysis (e.g. incompatible solutions) or mechanical hemolysis (e.g. improper storage). Can result in renal failure, shock and coagulopathy.
Transfusion Related Acute Lung Injury (TRALI)	1 in 12,000	Acute hypoxemia with evidence of new bilateral lung infiltrates on X-Ray and no evidence of circulatory overload. Patients often require ventilatory support. Usually occurs within 1-2 hours of start of transfusion and rarely after 6 hours. Usually resolves within 24-72 hours with death occurring in 5-10%. **Cause not fully understood.** Postulated to be related to donor or recipient antibodies acquired through pregnancy or transfusion.

Acute Reactions - Risk and Description

Acute Transfusion Reaction	Risk of Event	Description
Transfusion Associated Circulatory Overload (TACO)	1 in 100	Circulatory overload from excessively rapid transfusion and/or in patients at greater risk for overload (e.g. very young, elderly, impaired cardiac function). Preventative measures include slower transfusion rates and pre-emptive diuretics for patients at risk.
Hypotensive Reaction	Very Rare	Bradykinin mediated hypotension. Characterized by profound drop in blood pressure usually seen in patients on ACE Inhibitors unable to degrade bradykinin in blood component/product.

Parenteral Nutrition

- Define terminology related to parenteral nutrition (PN) and implications for vascular access.
- Discuss potential complications of PN and associated interventions
- Identify clinical implications for peripheral PN.
- Types and composition of PN.
- Indications for PN.
- Supplies and procedures for PN administration.

What is Parenteral Nutrition?

- Provides essential nutrients and calories intravenously, when the person cannot meet these needs through oral diet or enteral feeding
- PN composed of carbohydrates, fats, protein, amino acids, minerals and vitamins
- Amount of each component is individualised, based on patient assessment
- 3 types:
  - PPN: Peripheral Parenteral Nutrition
  - TPN: Total Parenteral Nutrition
  - TNA: Total nutrient admixture

Indications

- Bowel disorders such as short bowel syndrome
- Inflammatory bowel disease
- Fistulas
- Bowel Obstruction
- Malabsorption disorders (pancreatitis, cystic fibrosis)
- Motility Disorders
- Cancer

Administration

Continuous or Cyclic

- Continuous
  - Infusion over a 24 hour period
  - Patient is usually in a hospital setting
  - May be receiving PN, TPN or TNA
- Cyclical
  - 8-12 hr infusions, typically overnight
  - Preferred method as it allows patient more freedom during awake hours
  - More closely mimic normal oral intake (period of fasting between meals)
  - Decreases the risks associated with long term TPN

Complications

- **Most common** complication is VAD **infection**
- Prevention:
  - Aseptic Technique
  - Change dressing as per institution protocol
  - Change IV lines every 24 hrs or at the start of every new infusion
- Line occlusion
  - Fibrin sheath
  - Intraluminal occlusion from infusate

Complications

- Long term PN may lead to Fatty Liver disease
- Cholecystitis
  - Caused by lack of use of the Gut = Bile build up = inflammation
- Feelings of Hunger
  - Never actually feel full. Long term TPN without oral intake can lead to gut atrophy
- Refeeding Syndrome
  - Can occur when restarting solids